1979

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Young, A. (1979). Larval and postlarval development of the window-pane shell, Placuna placenta L. (Bivalvia: Placunidae). SEAFDEC Aquaculture Department Quarterly Research Report, 3(2), 4–7.

http://hdl.handle.net/10862/2345

Larval and postlarval development of the window-pane shell, *Placuna placenta* L. (Bivalvia: Placunidae)

Adam Young

Adult *Placuna placenta* (60-100 mm) obtained from commercial skin divers along Iloilo Strait were kept in the laboratory in running seawater at 28-30°C at a salinity of 27-29 ppt.

Mature window-pane shells that have been kept in running water for 3-5 days were easily induced to spawn by halting the flow of water for 3-5 hours, then changing the water completely. Female window-pane shells released unfertilized eggs with a sudden contraction of the adductor muscle which forcefully expels the eggs through the posteroventral margin. Strong jets of water produced by spawning females were easily observed in shallow spawning trays. Males released spermatozoa in steady streams. Eggs, released singly or, rarely, in short strings, were golden yellow and about 45 mm in diameter.

The main features of development are presented in Table 1. Fertilized eggs developed into straight-hinge veligers in less than 24 hours. The smallest straight hinge veliger observed was 50 um long x 43 um high although most were above 80 um in length.

Larvae of *P. placenta* have many characteristics common to larval *Anomiidae*. The larval shell is inequivalve, the umbo of the left valve knobby and caplike. Larvae are pale in color, with the digestive organs situated almost right beneath the umbo. However, by byssus notch, which when present, is a diagnostic feature of *Anomia* larvae was not observed in *Placuna*. In view of Yonge's (1977) findings, it is possible that in *P. placenta* larvae the byssal notch is reduced to a vestigial structure.

The shelf of the larvae is inequivalve at all stages of development (Fig. 1), and this condition is observed even in postlarvae, but there is no overlapping of the shell margins as reported for *Anomia lischkei* by Miyazaki (1935). Further, the larvae have a more pronounced knobby umbo, the anterior end is longer and more pointed and the ventral margin is shorter and bluntly pointed.

While Bernard (1896), Jorgensen (1946) and Rees (1950) reported a taxodont hinger for *Placunanomia, Anomia squamula* and the superfamily *Anomiacea* in general, consisting of 3-5 well developed teeth on either side of an intermediate area which is so thin that teeth are extremely minute, this is not the case in *Placuna*. The hinger is not taxodont and dentition is not similar on both valves, the left valve bears 2-3 large projecting provincular teeth on either end of an intermediate toothless area, for which there are corresponding cavities on the right valve.

Metamorphosis in *P. placenta* larvae commonly occurs at 220-230 um and is characterized by the disappearance of the velum and the appearance of an active foot. Moreover, metamorphosed larvae displayed extremely thin and transparent dissoconch growth clearly delineated from the prodissoconch by a narrow dark band. Loosanoff (1961) observed this phenomenon in *Anomia simplex* and termed it "partial" or interrupted metamorphosis.

Although direct observations were not made on settling larvae, they probably attach bysally to the water surface at metamorphosis and remain in the plankton for some time before finally settling on the mud bottom. This final settlement must be in response to a stimulus received from the desirable type of bottom through its overlying water.

The final sedentary phase of the life history in *Placuna* probably occurs at a size of 600 um, coincident with the appearance of the "sleeve" on the antero-dorsal margin of the shell. Personal observations of *P. placenta* in their natural habitat have revealed that this animal (although truly unattached and immobile) lives not on the surface of the mud, as is generally described, but under

a mud-camouflage, commonly bearing a layer (15-20 mm thick) of mud or silt on its shell, the presence of the organism detectable only by the shallow semicircular depression in the mud representing the area cleared by the foot in keeping the shell edges clean. The burrowing movements of juveniles observed in the laboratory suggest that this camouflage is effected not so much by silt settling on the shells as by a deliberate effort of the animal to be inconspicuous to predators.

Table 1. Summary of major features of larval development in *Placuna placenta* cultured at 27°C and 28-29 ppt salinity.

Stage	Age	Size range (um)	Shape/distinguishing features
Fertilized egg	0	Dia. 45 um	Golden yellow, spherical
Straight-hinge	20-30 h	L:50-105 H:43 - 98 D:25 - 52 HL:40 - 55	Smallest veliger 50 x 43 um; hinge line commonly 50-55 um, slightly curved, not increasing in length with growth. Ends of nearly equal length. Shells inequivalve
Umbo veliger	2-8 days	L:100-200 H: 80-200 D: 50 - 75	Shells inequivalve. Right valve flat with undeveloped umbo. Left valve rounded. At lengths beyond 150 um umbo of left valve projects well above the shoulders as a prominent knob. Shells nearly transparent; digestive organs situated almost beneath umbo. No byssus notch. Anterior end longer, more pointed. Ventral margin bluntly pointed.
Pediveliger	8-10 days	L:180-220 H:180-220 D: 65 - 80	Foot functional at L=170 um. Eyespots at L=150, commonly obscured by opaque mass of digestive gland. Metamorphosis at L:220-230.
Spat	10-11 days	Typically L:230 H:220 D: 80	Foot long, well developed. Velum absent. Dissoconch delineated by narrow dark band. Shells nearly transparent

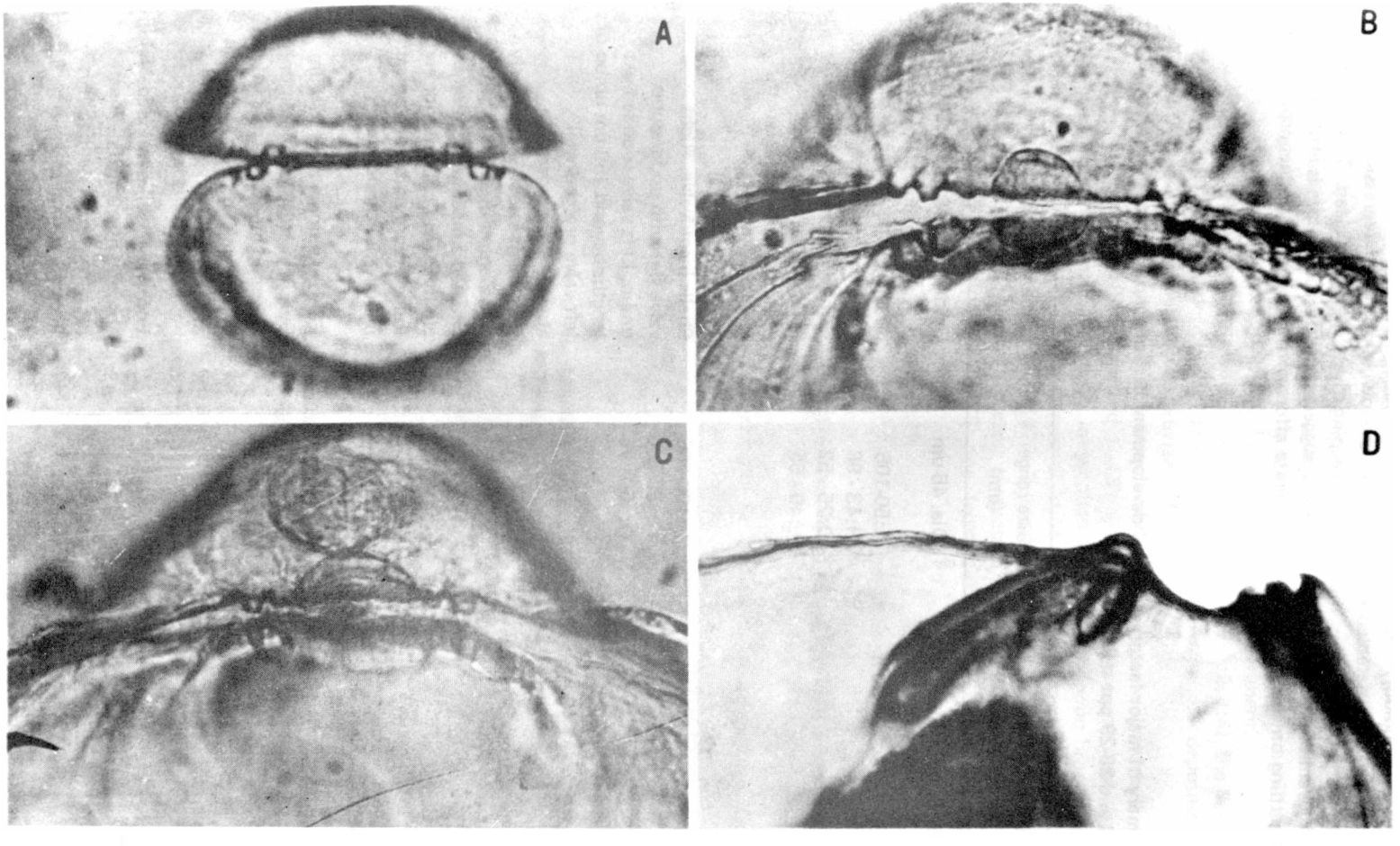

Fig. 1. Larval and postlarval hinge structure of *Placuna placenta*. Except in A, anterior end is right. Left valve uppermost.

A. Internal view of valves 90 um long
B. Dorsal view of slightly separated valves 210 um long. Internal ligament visible at center of hinge line. Note lack of umbo in right (lower) valve.
C. Dorsal view of valves 280 um long. Note enlarge ligaments.
D. Dorsal view of shell 4.8 mm long. Note the two arms of the primary ligament, anterior the shorter.

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